

Early in the next century, a whole new strawberry may grace our tables and our taste buds with its beauty and unique new flavors and textures. This year and next, six researchers across the country are selecting the best parents for reconstituting the commercial strawberry.

With clipboards in hand, the scientists roam plots of 20 to 40 elite genotypes of two species from North and South America, scoring each for about 18 characteristics growers and consumers prize. Their mission: Broaden the genetic base of today's strawberry and build a bigger, better one in the process.

The six researchers are evaluating the original two parent species of today's commercial strawberry, *Fragaria x ananassa*. It got its start accidentally some 250 years ago in a European botanical garden—the result of a chance hybridization between two New World species.

One parent, *F. virginiana*—good at tolerating heat and drought—arrived in Europe from North America by the late 1500s, possibly brought back by the legendary navigator and explorer Jacques Cartier. In the early 1700s, a French spy carried *F. chiloensis*, the other parent, from Chile. Acclaimed in Chile for its large fruit, it was a big disappointment in Europe. The spy had unwittingly collected only female plants that failed to produce fruit . . . until they were planted among *F. virginiana* clones years later.

"Now we can pick the most outstanding genotypes of those two parent species for breeding," says ARS geneticist Stan C. Hokanson, who is at Beltsville, Maryland.

Some of the elite genotypes come from the ARS National Clonal Germplasm Repository at Corvallis, Oregon. Others were recently collected in native habitats from Chile to the U.S. Rockies to Ontario, Canada, and evaluated by enthusiasts like James F. Hancock.

Professor of horticulture at Michigan State University in East Lansing, Hancock oversees the evaluation project. He

says about 10 serious evaluations have been done with New World genotypes.

"We tried to pick the best from these and select a representative sample. It's like doing the final cut."

Besides Hokanson, Hancock's other cooperators are ARS geneticist Chad E. Finn at Corvallis; James J. Luby, professor of horticulture at the University of Minnesota in St. Paul; Barbara L. Goulart, retired associate professor of horticulture at Pennsylvania State University in University Park; and Thomas M. Sjulín, research department manager with Driscoll Strawberry Associates, Inc., of Watsonville, California.

"The beauty of testing in multiple sites is that each site has a different stress regime," says Hokanson at Beltsville's Fruit Laboratory. "The sites provide extreme cold, high heat, dampness, widely varying soil quality, and different insects and diseases for us to evaluate genotype response."

Each genotype usually has something to offer, says Hokanson. For example, "one with small fruit may have fruit quality traits or disease resistance we can use." Researchers may also find genotypes to extend the fruiting season. The first strawberries to market command the highest prices. In Hokanson's plots last April, most of the species collection was in flower when commercially available cultivars were just waking from their winter naps.

One Peruvian genotype flowered nearly 2 weeks before the earliest cultivars. "It's exciting to find these kinds of outliers. They provide much more potential for improvement," Hokanson says. He adds that one genotype from Alabama and another from Mississippi were disease free last fall, "when all the cultivars were covered with leaf spot, scorch, and powdery mildew."

The researchers will also be looking for new sources of the day-neutral habit that keeps today's cultivars bearing fruit in cycles throughout the growing season. Until the late 1970s, commercial plants

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Small-fruit geneticist Stan Hokanson displays several elite wild strawberries collected by collaborators. The small, highly aromatic berries (left) are from plants collected in Alberta, Canada. The larger berries are from a type collected in Alaska that may prove to be cold hardy.



fruited for only a few weeks each season. Then Royce Bringhurst of the University of California at Davis collected a subspecies of *F. virginiana* that blooms out of season in Utah's Wasatch Range. Genes from that mountain clone revolutionized the industry.

Strawberries are grown around the world, mostly in the Northern Hemisphere. The United States, the leading producer, accounts for about 20 percent of the total, followed by Spain, Japan, Poland, Italy, Korea, and China. The lion's share of U.S. fresh-market production comes from California and Florida.

Driscoll's Tom Sjulín hopes to find genes for pest and disease resistance. He says some of the wild material promises good resistance to two diseases that plague growers in other parts of the country: verticillium wilt and red stele.

"There will be fewer and fewer chemicals in the future," says Sjulín, noting the impending loss of methyl bromide and possibly other important soil fumigants.

For California growers who plant a new crop each year, Sjulín wants to find genes that direct more energy into flowers and less into runners, as well as genes that trigger flowering under a wider range of temperatures. And he would like to capture the succulent taste of some eastern-grown strawberries for new West Coast cultivars.

ARS' Finn wants "to get a species core we know quite a lot about. Hopefully, other researchers will build on this information," he says.

Finn planted extra *F. chiloensis* genotypes in his plots at Corvallis because this species is indigenous to mild West Coast climates from northern California up to British Columbia, as well as down to Chile. "We have a better chance of growing them here," he says.

Most strawberries grown in the Pacific Northwest are for processing. So Finn will be watchful for fruit having rich color, high acidity, and high sugars

to fulfill processors' wish lists. And he hopes to find some novel characteristics. "Maybe there's something out there that doesn't rot for 2 weeks after harvest."

Sjulín says it will take at least 12 years—more likely 15 to 20—to get desirable traits from *F. virginiana* and *F. chiloensis* into a commercial variety. Fortunately, he adds, "Driscoll takes the long view on variety development and is committed to maintaining a broad genetic base."

The evaluation project is supported by a USDA small-fruit germplasm evaluation grant. Hancock's group at East Lansing multiplied the genotypes and distributed plants to cooperators. Everybody got a core group of about 20 genotypes. Some got more because of geographic location.

"It's amazing how many people have been willing to cooperate on this," says Hancock, who began the project 6 years ago with Luby and Adam Dale, professor of horticulture at the University of Guelph, Ontario. "We're all friends—we share a common interest."

Adds Hokanson, "What really makes this interesting is that we know how the cultivated strawberry originated accidentally, and now we can go back and do it better."—By **Judy McBride, ARS.**

This research is part of Plant, Microbial, and Insect Genetic Resources, Genomics, and Genetic Improvement, an ARS National Program described on the World Wide Web at <http://www.nps.ars.usda.gov/programs/cppvs.htm>.

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